Amendments to the Claims

The following listing of claims will replace all prior versions and listings of the claims in the above-identified application:

LISTING OF CLAIMS:

1. (Currently amended) A computer-implemented method for imaging of the properties of at least one ~~a~~ scattering target medium, comprising:

generating a first vector of measured data and a second vector of measured data, the first vector ~~of measured data~~ being indicative of energy emerging from the at least one ~~a~~ scattering target medium, the second vector ~~of measured data~~ being indicative of energy emerging from the at least one scattering ~~a~~ target medium, the emerging energy substantially originating from at least one source directing the energy into the at least one scattering target medium;

normalizing a difference between the first and second vectors ~~of measured data~~ according to a ratio of: (a) a difference between the first and second vectors, to (b) the second vector; ~~and~~

solving a modified perturbation ~~formulation~~ equation of ~~the~~ a radiation transport inverse problem for a relative change between a known property of a reference medium and ~~the~~ a corresponding unknown property of the at least one scattering ~~a~~ target medium, wherein the modified perturbation equation relates the normalized ~~measured data~~ difference and a vector of reference data for the known reference medium to the relative change in the property, the vector of reference data being indicative of energy emerging from the known reference medium; and

generating an image of the at least one scattering target medium, responsive to the solving.

2. (Cancelled)

3. (Currently amended) The computer-implemented method of claim 1 wherein energy sources and energy detectors are configured in corresponding source-detector pairs for the at least one scattering target medium and the reference medium, and the modified perturbation equation has the following form:

$$(\delta \mathbf{I}_r)_i = \left[\frac{I_i - (\mathbf{I}_0)_i}{(\mathbf{I}_0)_i} \right] (\mathbf{I}_r)_i; and$$

$$\mathbf{W}_r \bullet \delta\mathbf{x} = \delta\mathbf{I}_r$$

where ~~δx~~ $\delta\mathbf{x}$ is a vector of the relative changes between the ~~a~~ known property of the reference medium and the corresponding unknown property of the at least one scattering ~~a~~ target medium, ~~for corresponding volume elements of the reference medium and the target medium, the volume elements being an imaginary grid of contiguous regions forming a representation of the target medium and reference medium,~~

~~W'_r~~ $\mathbf{W}_r$ is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium;~~,~~

$\mathbf{I}_r$ ~~I_r~~ is the vector of reference data ~~indicative of energy emerging from the reference medium~~;

$(\mathbf{I}_r)_i$ is an element of $\mathbf{I}_r$ for an ith source-detector pair of the reference medium;~~,~~

I_i ~~I~~ is an element of the first vector ~~of measured data~~ for an ith source-detector pair of the at least one scattering target medium corresponding to the ith source-detector pair of the reference medium; ~~and~~

$\mathbf{I}_0$ ~~I_0~~ is the second vector ~~of measured data~~;

$(\mathbf{I}_0)_i$ is an element of $\mathbf{I}_0$ for the ith source-detector pair of the at least one scattering target medium;

$(\delta\mathbf{I}_r)_i$ represents a change in the vector of reference data for the ith source-detector pair of the reference medium; and

$\delta\mathbf{I}_r$ represents a change in the vector of reference data for all source-detector pairs of the reference medium.

4. (Currently amended) The computer-implemented method of claim 1 wherein the ~~normalization~~ normalizing the difference between ~~of~~ the first and second vectors ~~sets of~~

~~measured data~~ comprises ~~comprise~~ determining a ~~the natural~~ logarithm of ~~the~~ a ~~quotient~~ ratio of the first ~~set~~ vector ~~of measured data~~ to ~~and~~ the second vector ~~set of measured data~~.

5. (Currently amended) The computer-implemented method of claim 1 wherein energy sources and energy detectors are configured in corresponding source-detector pairs for the at least one scattering target medium and the reference medium, and the modified perturbation equation has the following form:

$$(\delta \mathbf{I}')_i = \ln \frac{I_i}{(\mathbf{I}_0)_i};$$

$$(\mathbf{W}'_r)_{ij} = \frac{(\mathbf{W}_r)_{ij}}{(\mathbf{I}_r)_i};$$

$$\delta \mathbf{I}' = \mathbf{W}_r' \delta \mathbf{x}$$

where $\delta \mathbf{x}$ ~~$\delta \mathbf{x}$~~ is a vector of the relative changes between the ~~a~~ known property of the reference medium and the corresponding unknown property of the at least one scattering ~~a~~ target medium ~~for corresponding volume elements of the reference medium and the target medium, the volume elements being an imaginary grid of contiguous, nonoverlapping regions forming a representation of the target medium and reference medium~~,

~~$\mathbf{W}_r$~~ $\mathbf{W}'_r$ is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium;

$(\mathbf{W}'_r)_{ij}$ is an element of $\mathbf{W}'_r$ for an ith source-detector pair of the reference medium and a jth volume element of the reference medium; ~~,~~ ~~where~~

~~$\mathbf{I}_r$~~ $\mathbf{I}_r$ is the vector of reference data ~~indicative of energy emerging from the reference medium~~;

$(\mathbf{I}_r)_i$ is an element of $\mathbf{I}_r$ for the ith source-detector pair of the reference medium; ~~,~~

~~I~~ I_i is an element of the first vector ~~of measured data~~ for an ith source-detector pair of the at least one scattering target medium corresponding to the ith source-detector pair of the reference medium; ~~and~~

~~$\mathbf{I}_0$~~ $\mathbf{I}_0$ is the second vector;

$(\mathbf{I}_0)_i$ ~~of measured data~~ is an element of $\mathbf{I}_0$ for the ith source-detector pair of the at least one scattering target medium; and

$\delta I'$ is a vector representing a relative difference between the first and second vectors that is mapped onto the reference medium.

6. (Currently amended) The computer-implemented method of claim 1 wherein the unknown property which is solved for by the solving includes ~~is~~ at least one of an absorption coefficient and a scattering coefficient.

7. (Currently amended) The computer-implemented method of claim 1 wherein the first and second vectors ~~vector of measured data and second vector of measured data~~ are obtained from one scattering target medium.

8. (Currently amended) The computer-implemented method of claim 1 wherein the first and second vectors ~~vector of measured data~~ are ~~is~~ obtained from different ~~a first target and the second vector of measured data is obtained from a second~~ scattering target mediums.

9. (Currently amended) The computer-implemented method of claim 1 wherein the first and second vectors ~~vector of measured data~~ are ~~is~~ obtained at different time instants to provide dynamic imaging data of the at least one scattering target medium ~~a first instant in time and the second vector of measured data is obtained at a second instant in time~~.

10. (Currently amended) The computer-implemented method of claim 1 wherein the first vector ~~of measured data~~ is obtained at a first instant in time and the second vector ~~of measured data is~~ represents a time averaged mean of a plurality of measurements.

11. (Currently amended) The ~~A~~ computer-implemented method of claim 1 further comprising generating a cross-sectional image ~~an image~~ representing the ~~cross-sectional~~ relative changes in the property.

12. (Currently amended) A system for imaging of the properties of at least one ~~a~~ scattering target medium, comprising:

means for generating a first vector of measured data and a second vector of measured data, the first vector ~~of measured data~~ being indicative of energy emerging from the at least one scattering ~~a~~ target medium, the second vector ~~of measured data~~ being indicative of energy emerging from at least one scattering ~~a~~ target medium, the emerging energy substantially originating from at least one source directing the energy into the at least one scattering target medium;

means for normalizing a difference between the first and second vectors ~~of measured data~~ according to a ratio of: (a) a difference between the first and second vectors, to (b) the second vector; ~~and~~

means for solving a modified perturbation ~~formulation~~ equation of a ~~the~~ radiation transport inverse problem for a relative change between a known property of a reference medium and a ~~the~~ corresponding unknown property of at least one scattering ~~a~~ target medium, wherein the modified perturbation equation relates the normalized difference ~~measured data~~ and a vector of reference data for the known reference medium to the relative change in the property, the vector of reference data being indicative of energy emerging from the known reference medium; and

means for generating an image of the at least one scattering target medium, responsive to the solving.

13. (Cancelled)

14. (Currently amended) The system of claim 12 wherein energy sources and energy detectors are configured in corresponding source-detector pairs for the at least one scattering target medium and the reference medium, and the modified perturbation equation has the following form:

$$(\delta \mathbf{I}_r)_i = \left[\frac{I_i - (\mathbf{I}_0)_i}{(\mathbf{I}_0)_i}\right](\mathbf{I}_r)_i ; and$$

$$\mathbf{W}_r \bullet \delta\mathbf{x} = \delta\mathbf{I}_r$$

where $\delta\mathbf{x}$ ~~δx~~ is a vector of the relative changes between the ~~a~~ known property of the reference medium and the corresponding unknown property of the at least one scattering ~~a~~ target medium;~~,~~ ~~for corresponding volume elements of the reference medium and the target~~

~~medium, the volume elements being an imaginary grid of contiguous regions forming a representation of the target medium and reference medium,~~

~~W'_r~~ $\underline{\mathbf{W}_r}$ is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium;~~,~~

~~I_r~~ $\underline{\mathbf{I}_r}$ is the vector of reference data~~ indicative of energy emerging from the reference medium~~;

$\underline{(\mathbf{I}_r)_i}$ <u>is an element of</u> $\underline{\mathbf{I}_r}$ <u>for an *i*th source-detector pair of the reference medium;</u>~~,~~

~~I~~ $\underline{I_i}$ is <u>an element of</u> the first vector ~~of measured data~~ <u>for an *i*th source-detector pair of the at least one scattering target medium corresponding to the *i*th source-detector pair of the reference medium;</u> ~~and~~

~~I_0~~ $\underline{\mathbf{I}_0}$ is the second vector;

$\underline{(\mathbf{I}_0)_i}$ <u>is an element of</u> $\mathbf{I}_0$ ~~of measured data~~ <u>for the *i*th source-detector pair of the at least one scattering target medium;</u>

$\underline{(\delta\mathbf{I}_r)_i}$ <u>represents a change in the vector of reference data for the *i*th source-detector pair of the reference medium; and</u>

$\underline{\delta\mathbf{I}_r}$ <u>represents a change in the vector of reference data for all source-detector pairs of the reference medium</u>.

15. (Currently amended) The system of claim 12 wherein the <u>normalizing</u> ~~normalization~~ of the <u>difference between the</u> first and second <u>vectors</u> ~~sets of measured data~~ <u>comprises</u> ~~comprise~~ determining ~~the~~ <u>a</u> ~~natural~~ logarithm of <u>a ratio</u> ~~the quotient~~ of the first <u>vector</u> ~~set of measured data~~ <u>to</u> ~~and~~ the second <u>vector</u> ~~set of measured data~~.

16. (Currently amended) The system of claim 12 wherein <u>energy sources and energy detectors are configured in corresponding source-detector pairs for the at least one scattering target medium and the reference medium, and</u> the modified perturbation equation has the following form:

$$(\delta \mathbf{I}')_i = \ln \frac{I_i}{(\mathbf{I}_0)_i};$$

$$(\mathbf{W}'_r)_{ij} = \frac{(\mathbf{W}_r)_{ij}}{(\mathbf{I}_r)_i};$$

$$\delta \mathbf{I}' = \mathbf{W}_r' \delta \mathbf{x}$$

where $\delta\mathbf{x}$ ~~δx~~ is a vector of the relative changes between the ~~a~~ known property of the reference medium and the corresponding unknown property of the at least one scattering ~~a~~ target medium ~~for corresponding volume elements of the reference medium and the target medium, the volume elements being an imaginary grid of contiguous, nonoverlapping regions forming a representation of the target medium and reference medium,~~;

~~W_r~~ $\mathbf{W}'_r$ is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium;

$(\mathbf{W}'_r)_{ij}$ is an element of $\mathbf{W}'_r$ for an ith source-detector pair of the reference medium and a jth volume element of the reference medium;~~, where I_r~~

$\mathbf{I}_r$ is the vector of reference data ~~indicative of energy emerging from the reference medium~~;

$(\mathbf{I}_r)_i$ is an element of $\mathbf{I}_r$ for the ith source-detector pair of the reference medium;~~,~~

~~I~~ I_i is an element of the first vector ~~of measured data~~ for an ith source-detector pair of the at least one scattering target medium corresponding to the ith source-detector pair of the reference medium; ~~and~~

$\mathbf{I}_0$ ~~I_0~~ is the second vector;

$(\mathbf{I}_0)_i$ is an element of $\mathbf{I}_0$ ~~of measured data~~ for the ith source-detector pair of the at least one scattering target medium; and

$\delta\mathbf{I}'$ is a vector representing a relative difference between the first and second vectors that is mapped onto the reference medium.

17. (New) The computer-implemented method of claim 1, wherein solving the modified perturbation equation comprises mapping the normalized difference onto the reference medium.

18. (New) A computer-implemented method for imaging of the properties of at least one scattering target medium, wherein energy is directed into the at least one scattering target medium using a plurality of energy sources, and the energy as it emerges from the at least one scattering target medium is detected using a plurality of energy detectors, the method comprising:

generating first and second vectors of measured data responsive to readings from the energy detectors;

generating a reference vector from a reference medium that models the at least one scattering target medium, based on energy directed into the reference medium by a plurality of energy sources that model the plurality of energy sources of the at least one scattering target medium, and based on energy detected from the reference medium by a plurality of energy detectors that model the plurality of energy detectors of the at least one scattering target medium;

calculating a normalized difference between the first and second vectors of measured data according to a ratio of: (a) a difference between the first and second vectors, to (b) the second vector;

calculating a difference vector based on a product of the normalized difference and the reference vector;

solving a perturbation equation using the difference vector to obtain a vector representing a property of the at least one scattering target medium; and

generating an image of the at least one scattering target medium based on the vector representing the property of the at least one scattering target medium.

19. (New) A medium on which computer code is embodied, the computer code being executable by a computer to perform a method for imaging of the properties of at least one scattering target medium, wherein energy is directed into the at least one scattering target medium using a plurality of energy sources, and the energy as it emerges from the at least one scattering target medium is detected using a plurality of energy detectors, the method comprising:

generating first and second vectors of measured data responsive to readings from the energy detectors;

generating a reference vector from a reference medium that models the at least one scattering target medium, based on energy directed into the reference medium by a plurality of energy sources that model the plurality of energy sources of the at least one scattering target medium, and based on energy detected from the reference medium by a plurality of energy detectors that model the plurality of energy detectors of the at least one scattering target medium;

calculating a normalized difference between the first and second vectors of measured data according to a ratio of: (a) a difference between the first and second vectors, to (b) the second vector;

calculating a difference vector based on a product of the normalized difference and the reference vector;

solving a perturbation equation using the difference vector to obtain a vector representing a property of the at least one scattering target medium; and

generating an image of the at least one scattering target medium based on the vector representing the property of the at least one scattering target medium.